

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of:
HUI-JUNG WU, ET AL.

Docket: 30-4731 (4780) DIV-1

Serial Number:

Group Art Unit:

Filed:

Examiner:

For: USE OF MULTIFUNCTIONAL SI-BASED OLIGOMER/POLYMER FOR THE
SURFACE MODIFICATION OF NANOPOROUS SILICA FILMS

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Prior to the substantive examination of this case, please amend the above identified patent application as follows:

In the specification:

On page 1, line 7, after CROSS REFERENCE TO RELATED APPLICATION, please change the sentence to read:

This patent application is a division of U.S. patent application serial number 09/488,075 filed January 20, 2001 which was a continuation-in-part of, and claims the benefit of provisional application serial number 60/117,248, filed on January 26, 1999, the disclosure of which is incorporated by reference herein in its entirety.

In the claims:

2. (Amended) The [process of claim 1] dielectric film of claim 20 wherein said reaction is conducted in the presence of at least one solvent or co-solvent.
3. (Amended) The [process of claim 1] dielectric film of claim 20 wherein said silica film is a nanoporous dielectric film having a pore structure that comprises silanols, and wherein said

reaction is conducted for a period of time sufficient for said surface modification agent to produce a treated nanoporous silica film having a dielectric constant of about 3 or less.

4. (Amended) The [process of claim 1] dielectric film of claim 3 that produces a nanoporous silica film having a dielectric constant ranging from about 1.1 to about 3.0.

5. (Amended) The [process of claim 1] dielectric film of claim 20 wherein said reaction is conducted at a temperature ranging from about 10°C to about 300°C.

6. (Amended) The [process of claim 1] dielectric film of claim 20 wherein said reaction is conducted for a time period ranging from about 10 seconds to about 1 hour.

7. (Amended) The [process of claim 1] dielectric film of claim 20 wherein said surface modification agent is a polymer or oligomer that comprises functional groups that will react with silanols.

8. (Amended) The [process of claim 1] dielectric film of claim 7 wherein said surface modification agent is prepared by reacting a suitable monomer with water in a solvent to form said surface modification agent.

9. (Amended) The [process of claim 1] dielectric film of claim 2 wherein said solvent or co-solvent is selected from the group consisting of ethers, esters, ketones, glycol ethers, hydrocarbons, chlorinated solvents, low viscosity siloxanes and combinations thereof.

10. (Amended) The [process of claim 1] dielectric film of claim 2 wherein said co-solvent is selected from the group consisting of ethers, esters, ketones, glycol ethers, hydrocarbons, chlorinated solvents, low viscosity siloxanes and combinations thereof.

11. (Amended) The [process of claim 1] dielectric film of claim 8 wherein said monomer is selected from the group consisting of a siloxane, a silazane, a silane, a carbosilane, and combinations thereof.

12. (Amended) The [process of claim 1] dielectric film of claim 8 wherein said water is present in said co-solvent in a concentration ranging from about 0.05 to about 10 percent, by weight, relative to the co-solvent.

13. (Amended) The [process of claim 1] dielectric film of claim 8 wherein said water is present during said reaction in proportion to said monomer in a ratio ranging from about 0.50:1.5 to about 1.5:0.5, mole/mole.

14. (Amended) The [process of claim 1] dielectric film of claim 8 wherein said monomer compound is selected from the group consisting of said monomer compound is selected from the

group consisting of methyltriacetoxysilane, phenyltriacetoxysilane, tris(dimethylamino)methylsilane, tris(dimethylamino)phenylsilane, tris(diethylamino)methylsilane and combinations thereof.

15. (Amended) The [process of claim 1] dielectric film of claim 20 wherein the composition comprises an oligomer or polymer surface modification agent and a monomer surface modification agent, wherein said monomer is reactive with silanol groups on said silica film.

16. (Amended) The [process of claim 1] dielectric film of claim 20 wherein said silica film is pre-treated with a monomer surface modification agent, wherein said monomer is reactive with silanol groups on said silica film.

17. (Amended) The [process of claim 1] dielectric film of claim 8 further comprising adding at least one additional monomer to said solution after the water is fully reacted, wherein said monomer is reactive with silanol groups on said silica film.

18. (Amended) The [process of claim 1] dielectric film of claim 15 wherein the monomer surface modification agent is an selected from the group consisting of siloxanes, silazanes, silanes, carbosilanes and combinations thereof.

19. (Amended) The [process of claim 1] dielectric film of claim 15 wherein the monomer surface modification agent is selected from the group consisting of acetoxymethyltrimethylsilane, diacetoxymethyltrimethylsilane, methyltriacetoxysilane, phenyltriacetoxysilane, diphenyldiacetoxysilane, trimethylethoxysilane, trimethylmethoxysilane, 2-trimethylsiloxypent-2-ene-4-one, n-(trimethylsilyl)acetamide, 2-(trimethylsilyl) acetic acid, n-(trimethylsilyl)imidazole, trimethylsilylpropionate, trimethylsilyl(trimethylsiloxy)-acetate, nonamethyltrisilazane, hexamethyldisilazane, hexamethyldisiloxane, trimethylsilanol, triethylsilanol, triphenylsilanol, t-butyltrimethylsilanol, diphenylsilanediol, tris(dimethylamino)methylsilane, tris(dimethylamino)phenylsilane, tris(dimethylamino)silanemethyltrimethoxysilane, methyltris(methylethylkeoxime)silane. methyltrichlorosilane, and combinations thereof.

Cancel Claim 1.

CLEAN AMENDED CLAIMS

2. The dielectric film of claim 20 wherein said reaction is conducted in the presence of at least one solvent or co-solvent.
3. The dielectric film of claim 20 wherein said silica film is a nanoporous dielectric film having a pore structure that comprises silanols, and wherein said reaction is conducted for a period of time sufficient for said surface modification agent to produce a treated nanoporous silica film having a dielectric constant of about 3 or less.
4. The dielectric film of claim 3 that produces a nanoporous silica film having a dielectric constant ranging from about 1.1 to about 3.0.
5. The dielectric film of claim 20 wherein said reaction is conducted at a temperature ranging from about 10°C to about 300°C.
6. The dielectric film of claim 20 wherein said reaction is conducted for a time period ranging from about 10 seconds to about 1 hour.
7. The dielectric film of claim 20 wherein said surface modification agent is a polymer or oligomer that comprises functional groups that will react with silanols.
8. The dielectric film of claim 7 wherein said surface modification agent is prepared by reacting a suitable monomer with water in a solvent to form said surface modification agent.
9. The dielectric film of claim 2 wherein said solvent or co-solvent is selected from the group consisting of ethers, esters, ketones, glycol ethers, hydrocarbons, chlorinated solvents, low viscosity siloxanes and combinations thereof.
10. The dielectric film of claim 2 wherein said co-solvent is selected from the group consisting of ethers, esters, ketones, glycol ethers, hydrocarbons, chlorinated solvents, low viscosity siloxanes and combinations thereof.
11. The dielectric film of claim 8 wherein said monomer is selected from the group consisting of a siloxane, a silazane, a silane, a carbosilane, and combinations thereof.
12. The dielectric film of claim 8 wherein said water is present in said co-solvent in a concentration ranging from about 0.05 to about 10 percent, by weight, relative to the co-solvent.
13. The dielectric film of claim 8 wherein said water is present during said reaction in proportion to said monomer in a ratio ranging from about 0.50:1.5 to about 1.5:0.5, mole/mole.

14. The dielectric film of claim 8 wherein said monomer compound is selected from the group consisting of said monomer compound is selected from the group consisting of methyltriacetoxysilane, phenyltriacetoxysilane, tris(dimethylamino)methylsilane, tris(dimethylamino)phenylsilane, tris(diethylamino)methylsilane and combinations thereof.

15. The dielectric film of claim 20 wherein the composition comprises an oligomer or polymer surface modification agent and a monomer surface modification agent, wherein said monomer is reactive with silanol groups on said silica film.

16. The dielectric film of claim 20 wherein said silica film is pre-treated with a monomer surface modification agent, wherein said monomer is reactive with silanol groups on said silica film.

17. The dielectric film of claim 8 further comprising adding at least one additional monomer to said solution after the water is fully reacted, wherein said monomer is reactive with silanol groups on said silica film.

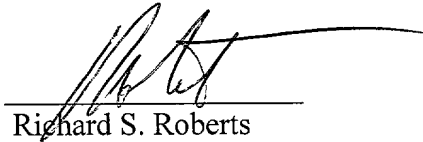
18. The dielectric film of claim 15 wherein the monomer surface modification agent is an selected from the group consisting of siloxanes, silazanes, silanes, carbosilanes and combinations thereof.

19. The dielectric film of claim 15 wherein the monomer surface modification agent is selected from the group consisting of acetoxytrimethylsilane, diacetoxymethylsilane, methyltriacetoxysilane, phenyltriacetoxysilane, diphenyldiacetoxysilane, trimethylethoxysilane, trimethylmethoxysilane, 2-trimethylsiloxypent-2-ene-4-one, n-(trimethylsilyl)acetamide, 2-(trimethylsilyl) acetic acid, n-(trimethylsilyl)imidazole, trimethylsilylpropionate, trimethylsilyl(trimethylsiloxy)-acetate, nonamethyltrisilazane, hexamethyldisilazane, hexamethyldisiloxane, trimethylsilanol, triethylsilanol, triphenylsilanol, t-butyltrimethylsilanol, diphenylsilanediol, tris(dimethylamino)methylsilane, tris(dimethylamino)phenylsilane, tris(dimethylamino)silanemethyltrimethoxysilane, methyltris(methylethylkeoxime)silane, methyltrichlorosilane, and combinations thereof.

REMARKS

The undersigned respectfully requests substantive examination of this application in view of the above.

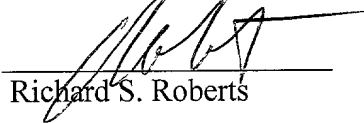
Respectfully submitted,



Richard S. Roberts
Reg. No. 27,941
P.O. Box 484
Princeton, New Jersey 08542
(609) 921-3500
Date: April 24, 2001

Express Mail mailing label number EF319895406US
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Richard S. Roberts